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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/590,636	08/23/2006	Woo-Nyon Kim	58266/J257	2260

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EXAMINER	
WYROZEBSKI LEE, KATARZYNA I	

ART UNIT	PAPER NUMBER
1796	

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10/30/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/590,636	KIM ET AL.	
	Examiner	Art Unit	
	Katarzyna Wyrozebski	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8/23/06; 10/13/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claim Objections

1. Claim 2 is objected to because of the following informalities: the applicants should incorporate full names of isocyanate compounds not just abbreviations. Appropriate correction is required.

Claim interpretation: Limitation of claim 7 is considered inherent, since as shown in the prior art, the isocyanate group is not destroyed upon reaction with organoclay. IR stretch frequency will therefore be preserved.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-7, 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over TIEN (*Macromolecules,* 2001) in view of KYLO (US 6,410,635) or KYLO in view of CHEN.

The article of TIEN discloses process for making polyurethane nanocomposite. From the reaction scheme shown on 2nd page of the article, it is evident, that montmorillonite type clay is first pre-treated with ammonium compound bearing –OH group and then reacted with diisocyanate, or pre-polymer carrying isocyanate terminal.

Experimental section – the pre-polymer in that particular experiment is MDI or diphenylmethane diisocyanate, therefore it is a polymeric MDI at room temperature. Solvent used was DMF. Clay and prepolymer were mixed together in DMF and butanediol was added, stirred for 2 hours to provide polyurethane polymer also at room temperature. Polymerization was completed in mold cast at increased temperature of 70°C. Although the prior art of TIEN

does not disclose the rpm utilized to stir the reaction products and mixtures, such variable is dependent on the equiment available and can be adjusted accordingly to afford exfoliation of the composite.

Amounts of clay and NCO are disclosed in Table on page 3 of the article. The amount of the NCO added, depends greatly on the cationic exchange capacity of the clay component, the amount of ammonium compound present, and the amount of ammonium that underwent the cationic exchange. The details of cationic exchange were described in reference 20 of TIEN, which utilized excess of ammonium compound. Therefore the ratio of NCO to OH is at least 1:1.

Resulting nanocomposite has improved physical properties such as Young's modulus, tensile strength and elongation to break by at least 1.3 fold.

The prior art of KYLO discloses composition for nanocomposite, also containing clay, which this time is treated with acid. In col. 8, KYLO teaches that the clay cane be treated with acid prior to intercalation and subsequently neutralized or reacted with functional group of the intercalating compound, wherein pretreatment is an option left to one of ordinary skill in the art.

The reactive group according to col. 8 is -OH, COOH , NCO and the like (also see claims). The prior art of KYLO also teaches that the polyols are utilized as curing agents for NCO containing compounds and the types of polyols are clearly defined in col. 6.

In the light of the above disclosure it would be obvious to one having ordinary skill in the art at the time of the instant invention to utilize clay of KYLO that is treated by acid and nautralized in the teachings of TIEN and thereby obtain the claimed invention. In such neutralized clay silanol -OH group is the only functional equivalent of the -OH group of TIEN.

In addition, KYLO discloses that the reactive group of the intercalant is NCO.

At the same time it would also be obvious to utilize process of TIEN in the composition of KYLO, where the diisocyanate is utilized as intercalating agent and further polymerized to make polyurethane nanocomposite. Use of these precursors is contemplated by KYLO.

Resulting composites of both KYLO and TIEN provide composition where the clay is exfoliated into single platelets. Therefore, the combination of the two disclosures is also expected to provide exfoliated clay in polyurethane matrix.

6. Claims 1-7, 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over TIEN (*J. App. Pol. Sci.,* 2002) in view of KYLO (US 6,410,635) or KYLO in view of CHEN.

The article of TIEN discloses process for making polyurethane nanocomposite. From the reaction scheme shown on 2nd page of the article, it is evident, that montmorillonite type clay is first pre-treated with ammonium compound bearing –OH group and then reacted with diisocyanate, or pre-polymer carrying isocyanate terminal.

Experimental section – the pre-polymer in that particular experiment is MDI or diphenylmethane diisocyanate, therefore it is a polymeric MDI at room temperature. Solvent used was DMF. Clay and prepolymer were mixed together in DMF and butanediol was added, stirred for 2 hours to provide polyurethane polymer also at room temperature. Polymerization was completed in mold cast at increased temperature of 70°C. Although the prior art of TIEN does not disclose the rpm utilized to stir the reaction products and mixtures, such variable is

dependent on the equiment available and can be adjusted accordingly to afford exfoliation of the composite.

Amounts of clay and NCO are disclosed in Table on page 3 of the article. The amount of the NCO added, depends greatly on the cationic exchange capacity of the clay component, the amount of ammonium compound present, and the amount of ammonium that underwent the cationic exchange. The details of cationic exchange were described in reference 20 of TIEN, which utilized excess of ammonium compound. Therefore the ratio of NCO to OH is at least 1:1.

Resulting nanocomposite has improved physical properties such as Young's modulus, tensile strength and elongation to break by at least 1.3 fold.

The prior art of KYLO discloses composition for nanocomposite, also containing clay, which this time is treated with acid. In col. 8, KYLO teaches that the clay cane be treated with acid prior to intercalation and subsequently neutralized or reacted with functional group of the intercalating compound, wherein pretreatment is an option left to one of ordinary skill in the art.

The reactive group according to col. 8 is -OH, COOH , NCO and the like (also see claims). The prior art of KYLO also teaches that the polyols are utilized as curing agents for NCO containing compounds and the types of polyols are clearly defined in col. 6.

In the light of the above disclosure it would be obvious to one having ordinary skill in the art at the time of the instant invention to utilize clay of KYLO that is treated by acid and nautralized in the teachings of TIEN and thereby obtain the claimed invention. In such neutralized clay silanol -OH group is the only functional equivalent of the -OH group of TIEN. In addition, KYLO discloses that the reactive group of the intercalant is NCO.

At the same time it would also be obvious to utilize process of TIEN in the composition of KYLO, where the diisocyanate is utilized as intercalating agent and further polymerized to make polyurethane nanocomposite. Use of these precursors is contemplated by KYLO.

Resulting composites of both KYLO and TIEN provide composition where the clay is exfoliated into single platelets. Therefore, the combination of the two disclosures is also expected to provide exfoliated clay in polyurethane matrix.

7. Claims 8-12, 20 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over disclosures of TIEN and KYLO as applied to claims 1-7, 13-19 above, and further in view of FISHBACK (US 5,798,533).

The discussion of the disclosures of TIEN and KYLO from either one of the paragraphs 5 and 6 of this office action is incorporated here by reference.

The prior art of TIEN discloses specific embodiments and species utilized in the experimental sections. Together with KYLO the disclosures do not go deeply into principles and details of polyurethane foam polymerizations, and yet, it is an important aspect of instant invention.

With that in mind, the prior art of FISHBACK discloses all components required for polymerization of polyurethane foam with clay in general as filler.

The components include: water blowing agent; catalysts such as pentamethylenediethylenetriamine and triethylenediamine; chain extender (diol). Additives are further defined as fillers, cell regulators, dyes, pigments, foam stabilizers, flame retardants and the like.

The prior art of FISHBACK discloses compounds that are viewed as customary in processes that produce polyurethane foam. Such components are well established in the art and are therefore obvious choice to one of ordinary skill in the art.

In the light of the above disclosure, it would have been obvious to one having ordinary skill in the art at the time of the instant invention, to utilize the components of FISHBACK in the teachings of TIEN and KYLO to obtain polyurethane foams. As it was mentioned above, these components are well established in the art and therefore obvious. The choice of these components is not influenced by the presence of organoclay. In addition, FISHBACK discloses generic use of clay fillers in the foam of his invention.

8. Claims 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over disclosures of TIEN and KYLO as applied to claims 1-7, 13-19 above, and further in view of BEALL (US 5,760,121)

The discussion of the disclosures of TIEN and KYLO from either one of the paragraphs 5 and 6 of this office action is incorporated here by reference.

The prior art of TIEN discloses mixing of the composition to provide intercalated clay, however without providing choices of alternative methods of achieving adsorption of organic compounds between clay platelets.

BEALL, who also discloses process of making nanocoposites, offers such alternatives. Specifically in detailed explanation of its invention, the prior art of BEALL discloses, that one of the methods that facilitates intercalation and exfoliation of the clay platelets in addition to shear mixing is ultrasonic means. BEALL teaches that resonant vibrations cause the platelets to

vibrate and thus affect shear. Sonic vibrations therefore contribute to breaking agglomerates and formation of exfoliated clay. The frequency range of at most 200 kHz required by the applicants is an obvious frequency, since it is an upper bound of the ultrasonic frequency range described in any physics and general chemistry book. Temperatures and mixing times were already discussed by TIEN.

In the light of the above disclosure it would have been obvious to one having ordinary skill in the art at the time of the instant invention to utilize sonic vibration as means to obtaining exfoliated clay. Such method is viewed as equivalent to shear mixing, since one of ordinary skill in the art would still be capable of obtaining polyurethane nanocomposite.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katarzyna Wyrozebski whose telephone number is (571) 272-1127. The examiner can normally be reached on Mon-Thurs 8:30 AM-2:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu can be reached on (571) 272-1114. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katarzyna Wyrozebski/
Primary Examiner, Art Unit 1796
October 23, 2008